

CLAIMS

1. (Withdrawn) A method for detection of solid materials present within a medium of interest, the method comprising:

configuring the medium of interest within an electromagnetic circuit;

exciting the medium of interest using electromagnetic energy; and

determining an impedance value of said electromagnetic circuit, wherein said impedance value corresponds to an amount of solid material within the medium of interest.

2. (Withdrawn) The method of claim 1, wherein said electromagnetic circuit further comprises at least one of a microwave circuit and a radio frequency (RF) circuit.

3. (Withdrawn) The method of claim 1, wherein the medium of interest is excited into a plasma state by at least one of a microwave energy source and an RF source.

4. (Withdrawn) The method of claim 1, wherein said determining an impedance value further comprises determining a reflection coefficient magnitude value and a reflection coefficient phase value.

5. (Withdrawn) The method of claim 4, further comprising determining variations of said reflection coefficient magnitude and phase values over time.

6. (Withdrawn) A method for solid material detection in a photoresist removal system, the method comprising:

receiving an exhaust gas downstream with respect to a workpiece from which a photoresist material is removed;

configuring an electromagnetic circuit to include said exhaust gas;

exciting said exhaust gas using electromagnetic energy; and

determining an impedance value of said microwave circuit, wherein said impedance value corresponds to an amount of solid material within the exhaust gas.

7. (Withdrawn) The method of claim 6, wherein said electromagnetic circuit further comprises at least one of a microwave circuit and a radio frequency (RF) circuit.

8. (Withdrawn) The method of claim 6, wherein said exhaust gas is excited into a plasma state by at least one of a microwave energy source and an RF source.

9. (Withdrawn) The method of claim 6, wherein said determining an impedance value further comprises determining an impedance magnitude value and an impedance phase value.

10. (Withdrawn) The method of claim 9, further comprising determining variations of said impedance magnitude and phase values over time.

11. (Withdrawn) The method of claim 9, wherein said electromagnetic energy is applied at a power of about 200 watts (W) to about 400 W.

12. (Withdrawn) The method of claim 9, wherein said electromagnetic energy is applied at a power of about 300 watts (W).

13. (Withdrawn) The method of claim 9, further comprising utilizing said determined impedance values for endpoint detection of removal of said photoresist material.

14. (Previously Presented) A material detection system, comprising:
 - a plasma processing chamber configured to uniformly convey plasma onto a surface of a work-piece contained therein;
 - a flow path in fluid communication with the processing chamber, the flow path configured to contain a medium of interest transported to and from the plasma processing chamber, wherein the medium of interest contains a solid material, and/or a gaseous byproduct, or combinations thereof removed from the work-piece;
 - a volatilizing electromagnetic energy source downstream from the plasma processing chamber coupled to the flow path for exciting said medium of interest so as to volatize the solid material when present; and
 - an impedance measuring device for measuring an impedance value of an electromagnetic circuit, said electromagnetic circuit including said flow path therein, wherein said impedance value corresponds to an amount of solid material within said medium of interest.
15. (Original) The material detection system of claim 14, wherein said electromagnetic circuit further comprises at least one of a microwave circuit and a radio frequency (RF) circuit.
16. (Canceled)
17. (Original) The material detection system of claim 14, wherein said impedance measuring device is configured to determine an impedance magnitude value and an impedance phase value.
18. (Original) The material detection system of claim 17, further comprising a mechanism for determining variations of said impedance magnitude and phase values over time.

19. (Previously Presented) A plasma based semiconductor material removal system, comprising:

a plasma processing chamber configured to uniformly convey plasma onto a surface of a work-piece contained therein;

a volatilizing electromagnetic energy source coupled to an effluent carrying conduit downstream from a plasma processing chamber, wherein the volatilizing electromagnetic energy source is configured to cause excitation of a gas having reactive species therein, wherein the excited gas may include a solid material a gaseous byproduct, and combinations thereof removed from a semiconductor work-piece, and wherein the excitation is effective to volatize the solid material when present;

a mechanism for uniformly conveying the excited gas; and

an impedance measuring device for measuring an impedance value of an electromagnetic circuit, said electromagnetic circuit including said excited gas therein, wherein said impedance value corresponds to an amount of the solid material within said gas.

20. (Original) The system of claim 19, wherein said electromagnetic circuit further comprises at least one of a microwave circuit and a radio frequency (RF) circuit.

21. (Original) The system of 19, wherein said downstream electromagnetic energy source is configured to excite said medium of interest into a microwave plasma.

22. (Original) The system of claim 19, wherein said impedance measuring device is configured to determine an impedance magnitude value and an impedance phase value.

23. (Original) The system of claim 22, further comprising a mechanism for determining variations of said impedance magnitude and phase values over time.

24. (Previously Presented) The system of claim 22, wherein said downstream electromagnetic energy source is configured to apply power at a power level of about 200 watts (W) to about 400 W.

25. (Previously Presented) The system of claim 22, wherein said downstream electromagnetic energy source is configured to apply power at a power level of about 300 watts (W).

26. (Currently Amended) The system of claim 19, wherein said impedance measuring device is configured for facilitating endpoint detection of removal of said a photoresist material.

27. (Withdrawn) A method for implementing material removal from a semiconductor workpiece, the method comprising:

receiving an exhaust gas containing material removed from the workpiece;

applying a first power level to an electromagnetic circuit, said electromagnetic circuit containing said exhaust gas therein, wherein said first power level is sufficient to volatize solid material contained within said exhaust gas;

applying a second power level to said electromagnetic circuit for a selected duration; and

during said selected duration, using said electromagnetic circuit to detect the presence of remaining solid material within said exhaust gas.

28. (Withdrawn) The method of claim 27, wherein said electromagnetic circuit further comprises at least one of a microwave circuit and a radio frequency (RF) circuit.

29. (Withdrawn) The method of claim 27, further comprising measuring an impedance of said electromagnetic circuit to detect the presence of remaining solid material within said exhaust gas.

30. (Withdrawn) The method of claim 27, wherein said first power level is reapplied following said selected duration whenever remaining solid material is detected.

31. (Withdrawn) The method of claim 29, further comprising repeating said applying said first and second power levels until remaining solid material is no longer detected.

32. (Previously Presented) The material detection system of Claim 14, wherein the electromagnetic energy source is configured to provide a high power and a low power duty cycle, wherein the high power duty cycle is effective to volatize the solid material, and wherein the impedance measuring device is configured to be operative during the low power duty cycle.

33. (Previously Presented) The plasma based semiconductor material removal system of Claim 19, wherein the electromagnetic energy source is configured to provide a high power and a low power duty cycle, wherein the high power duty cycle is effective to volatize the solid material, and wherein the impedance measuring device is configured to be operative during the low power duty cycle.